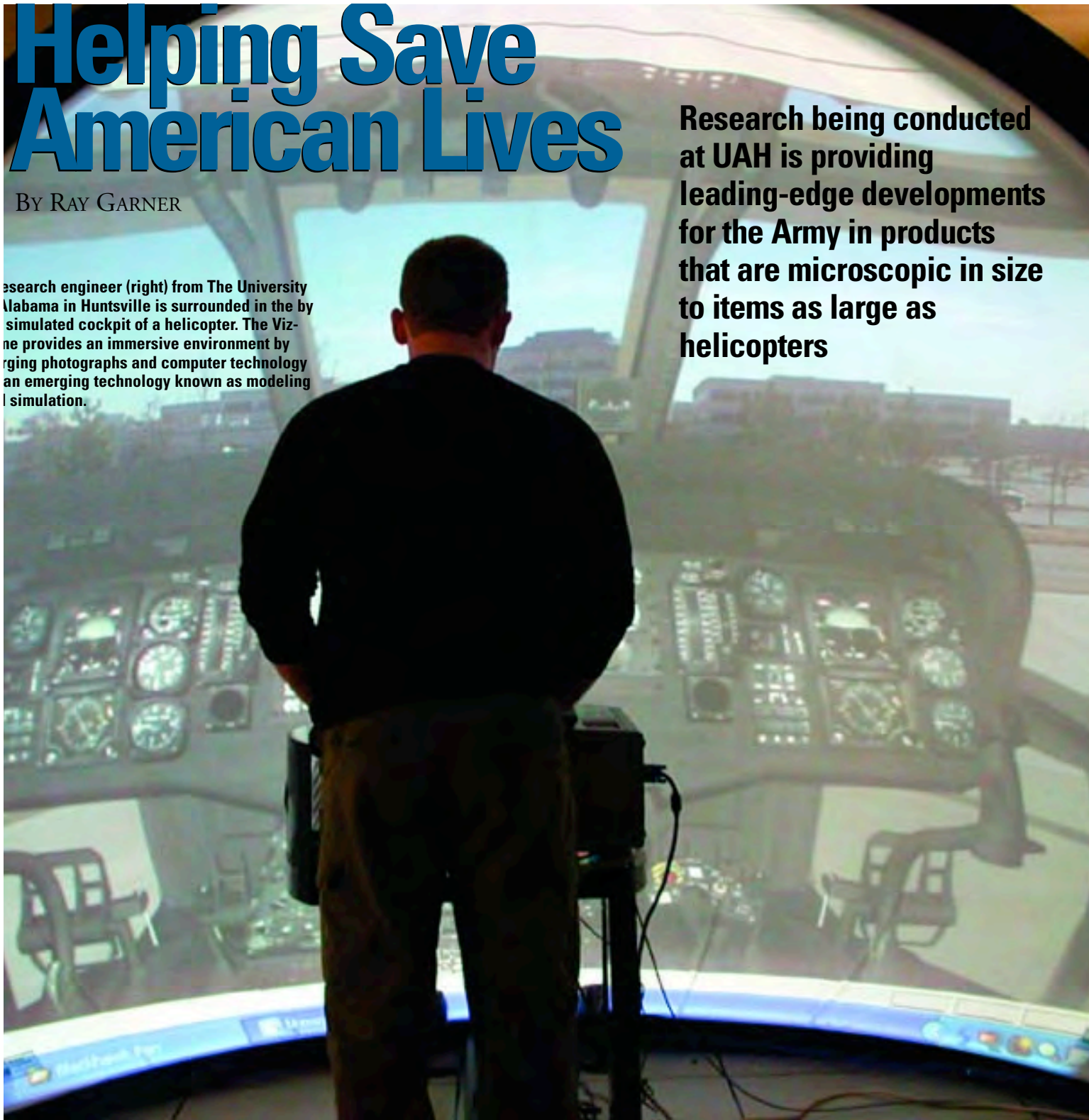


Helping Save American Lives

BY RAY GARNER

Research engineer (right) from The University of Alabama in Huntsville is surrounded in the by simulated cockpit of a helicopter. The Vizne provides an immersive environment by merging photographs and computer technology with an emerging technology known as modeling and simulation.

Research being conducted at UAH is providing leading-edge developments for the Army in products that are microscopic in size to items as large as helicopters



Men and machines will likely always play a role in armed conflict, but increasingly technology is changing how those conflicts will be carried out. The impact that scientific advances are having on how wars are conducted is rapidly improving America's ability to defend itself and helping save American lives abroad.

Quite a large number of those advances are taking place on university campuses across the country, including The University of

Alabama in Huntsville (UAH).

Research being conducted at UAH is providing leading-edge developments for the Army in products that are microscopic in size to items as large as helicopters. But the university's contributions don't end with hardware. Developments are taking place in processes as well as products to make American armed forces more effective.

Improvements in high-performance computing, modeling



The use of optics technology and lasers (above) have widespread application for propulsion and sensor development at The University of Alabama in Huntsville.

and simulation, software engineering and artificial intelligence, and nanotechnology are among emerging research areas for UAH, as well as devising state-of-the-art programs in rotorcraft and systems engineering, logistics, supply chain management and lean manufacturing.

“The Department of Defense is placing great emphasis on using technological advances to bring efficiency and more effectiveness to the nation’s

armed forces,” says Dr. Ron Greenwood, vice president for research. “Research being conducted at UAH is helping the Army meet those national priorities. The tremendous skills and talent that our university brings to this environment allows us to make significant improvements in how America’s armed forces operate domestically and around the world.”

UAH is creating a new laboratory to assist the Army in determining what types of computer architectures will provide the best configuration when a network of sensors are used in various situations, whether it is a battlefield scenario or homeland security.

Dr. Sara Graves, director of UAH’s Information Technology and Systems Center, says the challenge that exists for the Department of

Defense is how to solve complex problems with the best use of computational resources. The university’s Laboratory for High-Performance Computational Systems will take a close look at this issue, according to Graves.

“Certain applications lend themselves to certain types of computer architectural configurations,” she says. “One question is whether an application can be run more effectively on a cluster architecture, and what types of file handling capabilities are best for that same application.”

The UAH laboratory will also look at the analysis of data from a sensor

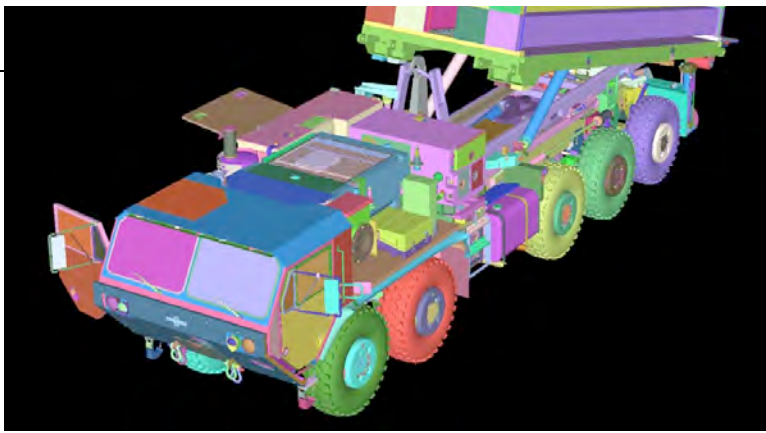
network, she said. The number of sensors in a network might vary from 10 to 10,000, but the ability to understand the data is of paramount importance for several defense needs. “These sensors are transmitting data 24/7, and we need to be able to process that information quickly,” she says. “Again, the question is what is the best computational infrastructure to process and interpret that data.”

The university is also conducting research for the sensors themselves. UAH scientists and engineers are creating extremely small devices used inside these sensors that can detect chemical or biological agents in the event of an attack, whether it is abroad or at home.

Greg Nordin, director of UAH’s Nano and Micro Devices Laboratory, and chemistry professor Michael George, are constructing very small cantilevers to serve as a central sensing device. These micro cantilevers are extremely small, but are relatively large in the nanotechnology environment. Each cantilever is approximately 100 microns long (about the width of a human hair) and about 30 microns wide.

Nordin and George say these devices are used to measure molecular interactions. “Each of these micro cantilevers have a material that is sensitive to various chemicals,” Nordin said. “If even a very small amount of a chemical agent is evident, then it chemically binds itself to the cantilever, causes a stress differential and the cantilever bends as a result.”

That bend is as small as 10 nanometers, a very small movement but one that can be detected by a light beam that reflects off of the altered device. When a certain number of these cantilevers have light deflected from their surface, a warning signal is then generated and transmitted by some type of communication device.



UAH produces computer-generated drawings of a missile launcher.

George and Nordin are seeking ways to retain the photonic ability to monitor a deflection as small as 10 nanometers and provide a “read out” mechanism. They have finished the design of this mechanism and the micro cantilever design. Nordin says computer-modeling shows the UAH design will work, but more time and money are necessary to develop a demonstration model.

Keeping American soldiers out of harm’s way is an emerging research discipline for the Department of Defense. Dr. Jim Snider, a member of the UAH faculty and a retired general, is developing a research and test center for unmanned vehicles (UV).

“UVs are designed to do the dull, dirty and dangerous work for U.S. security operations,” he explains. “Their use has increased dramatically over the last decade and their use will continue on an unprecedented pace as technological breakthroughs are achieved.”

The Army’s Aviation and Missile Research and Development Center at

UV technologies and products, not only in support of the Army but for all branches of our armed forces.”

Snider also serves as director of the university’s Rotorcraft Systems Engineering and Simulation Center. This center provides research and academic support for Redstone’s aviation activities. Students entering the 15-month program will earn a master’s degree in engineering and will be better prepared to develop new helicopters and unmanned vehicles when they return to their civil service jobs at Redstone Arsenal.

Similarly, UAH is poised to assist the Army in systems engineering. “The Army has initiated several efforts to improve systems engineering across the Department of Defense, citing poor systems engineering as a cause of several program failures,” Snider says. “While few outside of this environment understand the decline of systems engineering in the defense business, it is clearly understood inside this world.”

Snider says a recent summit was held to address the issue and the program

focused almost entirely on the need to correct systems engineering practices or face escalating costs and failures. UAH has established a partnership with the regional Defense Acquisition University and is continuing to build its existing programs in systems engineering,

including the recruitment of an eminent scholar.

But UAH’s support of Department of Defense activities moves beyond academic support and basic research. It includes refinement of processes as well. For instance, university faculty members are investigating methods of bringing efficiency to the Army’s management of logistics and supply chains.

“Increasingly, Department of Defense contractors are becoming more of an assembly operation than manufacturing,” says Bill Killingsworth, director of the university’s Center for Management and Economic Research. “So, you have a very complex, multi-tiered supply chain.”

Killingsworth and Jim Flinn, an



Dr. Kader Frendi is studying noise generation and reduction associated with aviation and aerospace. He is pictured in an anechoic chamber facility at UAH.

executive in residence, are studying those supply chains and finding methods of reducing the delivery time of products and how production rates can be improved. “It is simply a matter of squeezing out the waste of time,” Killingsworth says. “Some parts take as long as two years. We hope to reduce that time dramatically.”

Those improvements could mean saving a lot of money when these improvements are applied toward acquisition activities totaling billions of dollars. But, perhaps more importantly, the costly delivery of spare parts could save American lives as well. ■

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Huntsville’s Redstone is doing leading edge UV development work and Snider believes the growing need of UVs will outpace the research and testing infrastructure. “The research capabilities of UAH will allow for a more comprehensive and less expensive development of